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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 09/489,515
Filing Date: January 21, 2000
Appellant(s): PRAKASH ET AL.

Scott C. Harris
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed November 13, 2006 appealing from the Office action mailed April 4, 2006.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is incorrect. A correct statement of the status of the claims is as follows:

This appeal involves claims 19-22, 24-27 and 29-33. It appears to the examiner that the statement of the status of the claims contained in the brief incorrectly listed claims 29-33 as "20 9-33". (page 2 of the brief)

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

Summaries of claimed subject matter are submitted for claim 19, claim 26 and claim 27. For claim 27, the summary of claimed subject matter contained in the brief is correct.

For claims 19 and 26, the summary of claimed subject matter contained in the brief is deficient. 37 CFR 41.37(c)(1)(v) requires the summary of claimed subject matter to include: (1) a concise explanation of the subject matter defined in each of the independent claims involved in the appeal, referring to the specification by page and line number, and to the drawing, if any, by reference characters and (2) for each independent claim involved in the appeal and for each dependent claim argued separately, every means plus function and step plus function as permitted by 35 U.S.C. 112, sixth paragraph, must be identified and the structure, material, or acts described in the specification as corresponding to each claimed function must be set forth with reference to the specification by page and line number, and to the drawing, if any, by reference characters. The brief is deficient for claims 19 and 26 for the following reasons:

1) Claim 19 does not define a catalyst ink with a catalytic material having a liquid copolymer of tetrafluoroethylene and perfluorovinyl sulfonic acid. Instead, it is asserted that claim 19 defines a process for making a membrane electrode assembly for a fuel cell comprising, *inter alia*, a catalyst ink of catalytic material and polyvinylidene fluoride.

2) Claim 26 does not define a catalyst ink with polyvinylidene fluoride and a liquid copolymer. Instead, it is asserted that claim 26 defines a fuel cell comprising a membrane electrode assembly, the membrane electrode assembly being made by a process including providing a catalyst ink of a catalytic material and polyvinylidene fluoride.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is substantially correct. The changes are as follows:

Whether claim 26 is unpatentable under *35 U.S.C. 102(e)* or 103(a) based on Prakash et al. It appears to the examiner that the statement for claim 26 omitted the portion of the rejection made under 35 U.S.C. 102(e).

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

6,444,343 B1	Prakash et al.	9-2002
5,919,583	Grot et al.	7-1999
5,643,689	Fleisher et al.	7-1997
5,992,008	Kindler	11-1999
4,272,353	Lawrance et al.	6-1981

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim 26 is rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Prakash et al. (U.S. Pat. 6,444,343 B1).

Claim 26 is an independent claim.

Claim 26 recites a product-by-process limitation of the instant providing, applying and bonding of a catalyst ink. These process limitations have not given patentable weight as the limitations do not give breadth or scope to the product claim. The claimed product appears to be

the same or similar to the prior art product insofar as being a fuel cell comprising a catalyzed membrane electrode assembly with a PSSA-PVDF membrane having a second ionomer comprising a liquid copolymer of tetrafluoroethylene and perfluorovinylethersulfonic acid, e.g. Nafion H, which is a derivate of tetrafluoroethylene and perfluorovinylethersulfonic acid. See col. 8 line 49 et seq. In the event that any differences can be shown by the product of the product-by-process claims, such differences would have been obvious to the skilled artisan as a routine modification of the product absent of a showing of unexpected results. In re Thorpe, 227 USPQ 964 (Fed. Cir. 1985).

Claims 19, 20, 25-27, 32 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Grot et al. (U.S. Pat. 5,919,583, hereinafter Grot) in view of Fleisher et al. (U.S. Pat. 5,643,689) and Kindler (U.S. Pat. 5,992,008).

Claims 19, 26 and 27 are independent claims.

For claims 19 and 25-27, Grot et al. teaches providing a Pt catalyst ink material for a fuel cell, with a binder disclosed as being preferably the same polymer as in the membrane. See col. 8 lines 34-53.

For claim 20, in Grot et al. the temperature of bonding is from 150° C to 280° C. (col. 9 line 45-58) This range is considered to teach or at least suggest the claimed greater than about 180° C.

For claims 19, 26 and 27, Grot et al. does not explicitly teach applying the ink to a PSSA-PVDF membrane. However, Fleisher et al. teaches a matrix polymer, such as polyvinylidene fluoride (PVDF), together with a second polymer such as sulfonated polystyrenes, i.e.

polystyrene sulfonic acid or PSSA. See col. 7 lines 39-45, col. 8 line 40-62. Thus, the membrane is readable on the claimed PSSA-PVDF membrane combination. The skilled artisan would find obvious to employ this membrane in Grot et al.'s invention for reasons such as "(i) to improve the electrical contact between the non-liquid proton conductor membrane and the electrodes of the electrochemical system to obtain good conductivity... and (ii) to provide an electrochemical system having a proton conductor which by nature does not leach out." See Fleisher et al. in col. 4 line 64 to col. 5 line 3.

For claims 19, 26 and 27, Grot et al. does not explicitly teach providing polyvinylidene fluoride (PVDF). However, taking the combined teachings of Grot et al. and Fleisher et al. as a whole, the skilled artisan would find obvious without undue experimentation to employ the same polymer as a binder so as to remain consistent with Grot et al.'s disclosure, i.e. "[p]referably, the binder polymer is a polymer having cation exchange groups and *most preferably is the same polymer as in the membrane.*" See Grot et al. in col. 8 lines 41-43. Furthermore, it is the examiner's position that employing a catalyst ink of the same polymer as in the membrane would be an obvious modification to the skilled artisan in order to enhance the bonding of the catalyst ink to the membrane, e.g. the notoriously-known "like dissolves like" approach taught in a first-year college chemistry course.

For claims 19, 26 and 27, Grot et al. does not explicitly teach the addition of a second ionomer comprising a liquid copolymer of tetrafluoroethylene and perfluorovinylethersulfonic acid. However, Kindler teaches such a liquid copolymer in col. 3 lines 36-38, "NAFION(TM) is a co-polymer of tetrafluoroethylene and perfluorovinylether sulfonic acid." See also col. 6 line 28 et seq.) At the time the invention was made, it would have been obvious to one of ordinary

skill in the art to further modify Grot et al.'s invention by employing a liquid copolymer of tetrafluoroethylene and perfiuorovinylethersulfonic acid, for reasons such as enhancing ionic conduction and improving wetting properties within the electrode, *inter alia*. See Kindler et al. in col. 4 line 10 et seq.

As to claims 32 and 33, these claims are deemed taught or at least suggested by the prior art insofar as providing poly(vinylidene) fluoride in powder form merely requires providing this material as received from its manufacturer.

Claims 21, 22, 29 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Grot et al. in view of Fleisher et al. and Kindler, and further in view of Cabasso et al. (U.S. Pat. 5,783,325).

The teachings of Grot et al. are discussed above.

For claims 21, 22, 29 and 30, Grot et al. does not explicitly teach the claimed plasticizer. However, Cabasso et al. teaches in column 7 line 64 et seq. that "[s]uitable solvents for the polyvinylidene fluoride and carbon blend include... N,N-dimethyl acetamide ("DMA")", the solvent notably dissolving the polyvinylidene fluoride. The examiner notes that DMA is the same solvent disclosed by applicant as that which provides a plasticizing effect. The skilled artisan would find obvious to further modify Grot et al.'s invention by employing a plasticizer in order to enhance the dissolution of the polymeric material with the catalyst ink.

Claims 24 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Grot et al. in view of Fleisher et al. and Kindler, and further in view of Lawrance et al. (U.S. Pat. 4,272,353).

The teachings of Grot et al. are discussed above.

For claims 24 and 31, Grot et al. does not explicitly teach roughening the surface of the membrane prior to applying the catalyst ink. However, Lawrance et al. teach such a roughening step. See col. 2 lines 55-59. While the examiner asserts that the skilled artisan would find such a step obvious for reasons such as increasing the surface area of the membrane, in view of the teachings of Lawrance et al., a roughening step would be an obvious modification motivated by the enhanced bonding of the catalysts to the membrane support, as roughening provides "for locking, uniting, or fixing the finely divided catalyst particles to the surface of the solid polymer electrolyte membrane." (ib.)

(10) Response to Argument

Response to the 35 U.S.C. § 102(e) arguments for the rejection of claim 26 based on Prakash:

Appellant's arguments have been fully considered, however they are not found persuasive for the following reasons:

The rejection of claim 26 is based on a product-by process interpretation thereof based on Prakash. Appellant cites *In re Thorpe, Verdegaal Bros. v. Union Oil Co. of California* and *In re Garnero* as applicable case law. *Viz.*, for product-by-process claims, "determination of patentability is based on the product itself", a product-by-process claim "is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently

described, in a single prior art reference", and "the structure implied by the process steps should be considered when assessing the patentability of product-by-process claims." (emphasis as submitted) In light of the cited case law, appellant submits that as the process steps indicate that the catalyst ink contains PVDF, this structure must be considered in assessing the patentability of the claimed subject matter.

In reply, the examiner asserts that the structure implied by the catalyst ink containing PVDF has been given its fullest consideration. As to Prakash's catalyst ink not containing PVDF, it is asserted that the fuel cell taught by Prakash is the same as that claimed by appellant insofar as being a fuel cell comprising a catalyzed membrane electrode assembly with a PSSA/PVDF membrane. See the abstract and col. 3 line 17 et seq. The structure implied by the process step of "providing a catalyst ink comprising a catalytic material and poly(vinylidene fluoride)..." is catalytic material on a membrane. A membrane electrode assembly is a sandwich structure of a first electrode backing layer, a catalyst, a membrane, a catalyst and a second electrode backing layer. See col. 5 line 38 et seq. Thus, the membrane electrode assembly of Prakash is readable on the implied structure of catalytic material on a membrane. In making this assertion, the examiner submits that the structure implied by the process steps has been considered for patentability of the pending claims, but ultimately the structure implied by these process steps is deemed taught or at least suggested by Prakash.

As a final note, the catalyst ink itself is dried, leaving behind its solid substituents on the membrane. See page 6 lines 4-5 of the specification. It is the examiner's position that this condition further supports the structure implied by the process claims as merely being catalytic material on a PSSA/PVDF membrane.

Response to the 35 U.S.C. § 103(a) arguments for the rejection of claim 26 based on Prakash:

At the outset, the examiner notes that the pending rejection based on Prakash is more precisely set forth under 35 U.S.C. 102(e) **OR** 35 U.S.C. 103(a). The extent to which a 35 U.S.C. 103(a) rejection is made based on Prakash is solely to the extent that the claimed product appears to be the same or similar to the prior art product, i.e. the claimed product comprises PVDF, while the prior art product also comprises PVDF. Furthermore, it was asserted that in the event that any differences can be shown by the product of the product-by-process claims, such differences would have been obvious to the skilled artisan as a routine modification of the product absent of a showing of unexpected results. *In re Thorpe*, 227 USPQ 964 (Fed. Cir. 1985). In this respect, the examiner notes that no differences have been shown during prosecution or with the present appeal brief to patentably favor the product-by-process claim.

Appellant's arguments have been fully considered, however they are not found persuasive for the following reasons:

In the present brief appellant submits that Prakash's use of PVDF as an inert matrix in a membrane does not suggest the use of PVDF as an ionomer in a catalyst ink because the respective reasons for doing so are entirely different. Appellant then submits that Prakash provides no motivation to use PVDF in the catalyst ink.

In reply, and as noted in a prior Office action, the examiner concedes that there is *no modification* whatsoever proposed for in the teachings of Prakash. In the opinion of the examiner, to what extent Prakash and appellant's use of PVDF may be different, co-extensive or, for that matter, similar is irrelevant to the analysis of the claim in terms of the structure implied by the process steps.

Appellant's assertion of differences deemed "not insubstantial" is noted. Appellant submits that fuel cells having a catalyst ink containing PVDF (as in the present invention) have "improved interfacial bonding characteristics, which improves the electrical performance and reduces the impedance compared to membrane electrode assemblies having conventional inks that do not contain PVDF, i.e. the catalyst ink used by Prakash." (appeal brief, paragraph bridging pages 7-8) Appellant then cites page 2 lines 22-25 of the specification. In reply, and upon further review of the cited portion of the specification and related sections, the examiner cannot conclude that the catalyst ink used by Prakash falls under appellant's characterization of "conventional *inks*," as the specification merely sets forth a broad comparison of performance "with MEAs prepared by conventional *processes*." (emphasis added) See the specification on page 8. Though the specification touts alleged improvements of the claimed invention, at the same time the specification is entirely silent on the structural parameters of any comparative examples as a standard of measure. If by conventional *processes* the alleged improvements in interfacial bonding and electrical performance are a result of "[i]mproving the melt-flow characteristics of the polymer membrane during the hot pressing process [to enhance] the interfacial bonding" (see page 6 of the specification), the examiner asserts that these process features are outside the scope of the present product-by-process claims. Notwithstanding, it is noted that Prakash similarly teaches "improved electrode membrane interface characteristics..." See col. 7 line 46 et seq.

With respect to the assertion that PVDF has a low intrinsic permeability to methanol, thus lowering methanol crossover, in reply the examiner maintains that the fuel cell taught by Prakash in terms of these alleged differences is the same as that claimed by applicant insofar as the prior

art fuel cell also exhibits "decreasing methanol crossover rates..." which is deemed equal to the alleged "low intrinsic permeability to methanol" of the claimed invention. See col. 3 line 33 et seq.

Response to the 35 U.S.C. § 103(a) arguments for the rejection of claims 19, 20, 25-27, 32 and 33 based on Grot et al., Fleisher et al. and Kindler:

Appellant's arguments have been fully considered, however they are not found persuasive for the following reasons:

Firstly, appellant directs arguments to Fleisher, which is the secondary reference.

With respect to Fleisher, appellant submits that as the instant specification states that PSSA-PVDF do not swell significantly in water, the Office action has improperly concluded a motivation for employing a PSSA-PVDF membrane. Fleisher is said to teach a solvent such as water, which results in swelling of the membrane and thereby enhancing the electrical contact in the electrochemical cell. See the appeal brief, first full paragraph on page 9. In comparison, appellant submits on page 9 of the specification that the instant specification clearly states that the PSSA-PVDF membrane does not swell significantly in water. (no citation in support of this feature was provided by appellant)

In reply, and as set forth in the August 4, 2006 Advisory action, the examiner asserts that any arguments drawn to what applicant's specification may disclose, i.e. to what extent the membrane does not swell significantly in water, are not considered relevant to the claims, which are not found commensurate in scope and are in fact entirely silent on any property, structure or feature related to swelling of the membrane. Furthermore, the extent to which the instant

membrane does not swell significantly is unclear—the scope of the relative term "swell significantly" is not defined. It also appears to the examiner that the entire specification mentions PSSA/PVDF not swelling significantly upon hydration only once, on page 5 line 20.

Notwithstanding the foregoing, even if a PSSA-PVDF can be characterized to not swell significantly, the membrane nonetheless *still swells*—enough swelling in fact for Fleisher to specifically disclose that the "membrane *swells* and as a result [of this *swelling*] the electrical contact between the anode plate and/or the cathode plate and the membrane, improves." Emphasis added, see Fleisher in col. 2 lines 31-34.

Secondly, appellant directs arguments to the combination of Grot (the primary reference) and Fleisher, citing that if the proposed modification or combination of the cited reference would change the basic principle of operation of the cited reference being modified, then the teachings of the reference are not sufficient to render the claims *prima facie* obvious. *In re Ratti.* In reply, and following the guidance of this case law, the examiner asserts there is in fact *no change* in the prior art's basic principle of operation. On page 10 of the appeal brief, appellant submits that

> [a]ccording to the principle of operation of Grot, an inorganic filler is required to fill the interstices of a polymer membrane to slow or block organic fuels such as methanol from diffusing through a membrane. Grot, col. 10, lines 47-51.

In comparison thereto, on page 10 of the appeal brief, appellant submits that

> According to the principle of operation of the claimed subject matter, PSSA-PVDF membranes alone, or in combination with a catalyst ink containing PVDF, result in decreased methanol crossover rates due to the low intrinsic permeability of PVDF to methanol.

Thus, by appellant's own characterization, Grot's teaching of "*to slow or block* organic fuels such as *methanol*" is *no different* from the principle of operation of the claimed subject matter resulting in "*decreased methanol crossover rates*"; in the opinion of the examiner, Grot and

appellant are actually solving the same problem, and Grot's teaching of an inorganic filler would actually further enhance the desired lower rate of methanol crossover. (emphasis added)

The examiner notes that arguments submitted for Kindler (the tertiary reference) merely assert that this reference fails to remedy alleged differences of the primary and secondary references, maintained *supra*.

Response to the 35 U.S.C. § 103(a) arguments for the rejection of 21, 22, 29 and 30 based on Grot et al., Fleisher et al., Kindler and Cabasso et al.

The examiner notes that arguments submitted for Cabasso et al. (a quaternary reference) merely assert that this reference fails to remedy alleged differences of the primary, secondary and tertiary references, maintained *supra*.

Response to the 35 U.S.C. § 103(a) arguments for the rejection of 24 and 31 based on Grot et al., Fleisher et al., Kindler and Lawrance et al.

The examiner notes that arguments submitted for Lawrance et al. (a quaternary reference) merely assert that this reference fails to remedy alleged differences of the primary, secondary and tertiary references, maintained *supra*.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

PATRICK JOSEPH RYAN
SUPERVISORY PATENT EXAMINER

Julian Mercado
February 16, 2007

Conferees:
Patrick Ryan
William Krynski